

Taxonomic identity of *Primulina swinglei* (Gesneriaceae)

HONG Xin^{1,2}, KEENE Jeremy³, SHAN Wanyue¹, VAN DO Truong⁴, WEN Fang^{2,5*}

(1. School of Resources and Environmental Engineering, Anhui University, Hefei 230601, Anhui, China; 2. Guangxi Key Laboratory of Plant Conservation and Restoration Ecology in Karst Terrain, Gesneriad Conservation Center of China, Guangxi Institute of Botany, Guangxi Zhuang Autonomous Region and Chinese Academy of Sciences, Guilin 541006, Guangxi, China; 3. Glenville State College, Glenville, West Virginia, USA; 4. Vietnam National Museum of Nature, Vietnam Academy of Science & Technology, Hanoi, Vietnam; 5. Key Laboratory of Plant Resource Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China)

Abstract: *Chirita* Buch.-Ham. ex D. Don is a human-defined genus. Phylogenetic reconstruction of this genus and its related genera was carried out on the basis of molecular systematics research in 2011. Most of the species of Sect. *Gibbosaccus* C.B. Clark were incorporated into *Primulina* Hance. However, due to historical reasons, the limitations of early classical taxonomy in research methods and the understanding of vegetative organs and reproductive organs of some species of former *Chirita* need to be further studied, there are still some problems in the classification of some species of this genus, which need to be further studied. For example, in the process of studying Gesneriaceae plants distributed in China and Vietnam, we found that there are taxonomic problems in the identification of two species of *Primulina*: *Primulina swinglei*, which is widely distributed from Southwest China to the middle of Indochina Peninsula, and *P. laxiflora*, which was originally considered to be endemic to China and Guangxi. Further clarification is needed to clarify the relationship between the two species. In this paper, the morphological comparison of the two species was carried out. At the same time, through the original description comparison, plant specimen examination, cultivation observation and field observation of the two plants, we determined that *P. laxiflora* is the synonym of *P. swinglei*. In addition, the lectotype of *P. swinglei* is also designated here to confirm the taxonomic status of the species.

Key words: *Chirita*, lectotypification, new synonym, *Primulina laxiflora*, taxonomy

CLC number: Q949

Document code: A

钟冠报春苣苔 (*Primulina swinglei*) (苦苣苔科) 的分类鉴定

洪欣^{1,2}, KEENE Jeremy³, 单皖粤¹, VAN DO Truong⁴, 温放^{2,5*}

收稿日期: 2020-07-28

基金项目: 国家自然科学基金 (31860047); 安徽省自然科学基金 (1908085QC1); 广西喀斯特植物保育与恢复生态学重点实验室基金 (19-050-6); 第 21 批广西“十百千”人才工程第二层次入选项目; 广西植物研究所基本业务费 (桂植业 20009) [Supported by the National Natural Science Foundation of China (31860047); Anhui Provincial Natural Science Foundation (1908085QC1); Fund of Guangxi Key Laboratory of Plant Conservation and Restoration Ecology in Karst Terrain (19-050-6); 21st Talent project of “Ten-Hundred-Thousand” of Guangxi; Fundamental Scientific Research Fund of Guangxi Institute of Botany (Guizhiye20009)].

作者简介: 洪欣 (1989-), 男, 江苏苏州人, 博士, 讲师, 主要研究方向为植物生态学, (E-mail) hongxin@ahu.edu.cn。

***通信作者:** 温放, 博士, 研究员, 主要从事园林植物与观赏园艺、植物分类学、植物地理学、植物迁地保育、栽培与育种等方面的研究, (E-mail) wenfang760608@139.com。

(1. 安徽大学 资源与环境工程学院, 中国 安徽 合肥 230601; 2. 广西喀斯特地区植物保护与恢复生态重点实验室, 广西壮族自治区中国科学院广西植物研究所 中国苦苣苔科植物保育中心, 中国 广西 桂林 541000; 3. 格伦威尔州立大学, 美国 西弗吉尼亚州 格伦威尔市; 4. 越南国家自然博物馆, 越南科学技术学院, 越南 河内; 5. 中国科学院华南植物园植物资源保护与可持续利用重点实验室, 中国广州 510650)

摘要: 原唇柱苣苔属 (*Chirita* Buch.-Ham. ex D. Don) 为一个人为界定的属, 2011 年在分子系统学研究的基础上对该属及其近缘属开展了系统发育重建工作, 其中绝大部分的原唇柱苣苔属唇柱苣苔组 (Sect. *Gibbosaccus* C.B. Clark) 的物种被并入了广义报春苣苔属 (*Primulina* Hance)。然而由于历史原因、早期经典分类学在研究方法上的局限性以及对现报春苣苔属部分物种的营养器官与生殖器官的认识有待深入, 该属下一些物种的分类仍存在问题, 亟待深入研究。譬如, 在对中国和越南分布的苦苣苔科植物开展研究的过程中, 我们发现两个报春苣苔属的物种——广布于我国西南华南直至中南半岛中部的钟冠报春苣苔 (*Primulina swinglei*) 命名人 and 原被认为是中国与广西特有种的疏花报春苣苔 (*P. laxiflora*) 命名人之间的鉴定存在分类学问题, 需要进一步厘清两者之间的关系。本文对这两个物种进行了形态比较, 同时通过对这两种植物的原始描述对比、植物标本检查、栽培观察以及野外实地观察, 我们确定疏花报春苣苔是钟冠报春苣苔的异名。此外, 我们在这里明确了钟冠报春苣苔的指定模式标本。

关键词: 唇柱苣苔属, 后选模式指定, 新异名, 疏花报春苣苔, 分类学

1 Introduction

Primulina Hance (1883: 169) is a Sino-Vietnamese genus of the family Gesneriaceae consisting of at least 200 species of perennial rosette herbs (Möller 2019; Wen et al., 2019). The species grows mainly in wet, shaded, mountainous regions of South and Southwest China (especially Guangxi, Southeast Yunnan, Guizhou, North Guangdong and South Hunan) and North Vietnam (Wei et al., 2010; Weber et al., 2011; Wang et al., 2011; Möller et al., 2016) respectively revised the former genus *Chirita* Buch.-Ham. ex D. Don (1822: 83) and allied genera by utilizing molecular data. These studies showed that *Chirita* was a polyphyletic group and needed to be reorganized. This work then led to the synonymization of *Chirita* within an enlarged *Primulina* genus, due to naming priority. Before this reorganization, numerous new species of former *Chirita* were described by Wang (1984a, b, 1985) and Wang et al. (1990, 1998). Due to the limitation of research methods, field observations, and insufficient knowledge of flowers and fruits for certain species of former *Chirita*, the taxonomy of some species continues to be problematic.

During a review of Gesneriaceae from the Sino-Vietnam area, we found that specimens labeled as *Primulina swinglei* (Merrill 1918: 156) Mich. Möller & A. Weber in Weber et al. (2011: 785) and *P. laxiflora* (W. T. Wang 1985: 21) Yin Z. Wang in Wang et al. (2011: 61) are widely confused with each other. Our field investigations and examinations of type materials demonstrated that *P. laxiflora* is conspecific with *P. swinglei*, a species widely distributed in Southwest to South China to North Vietnam. We proposed that *P. laxiflora* should be reduced to a synonym of *P. swinglei*. The lectotype for *P. swinglei* is also designated here under the International Code of Botanical Nomenclature (Shenzhen Code) (Turland & Wiersema 2017; Turland et al., 2018). During our research on type specimens of *P. swinglei*, we found that two or more collections or two specimens were simultaneously designated as types, without indicating the holotype in the protologue. The lectotype for *P. swinglei* is also named here since this taxon was published based on syntypes, without mentioning the holotype.

2 Materials and Methods

Field investigation and specimen examination: We have conducted fieldwork in Guangxi and Guangdong provinces of China (including the type localities of *Primulina laxiflora* and *P. swinglei*) and North Vietnam since 2012. During the floristic field surveys, we observed living plants and collected specimens. Numerous new populations of *P. swinglei* were discovered during these field trips. Plants from different populations have been regularly monitored in the field since their discovery. Furthermore, some plants were collected to carry out cultivation experiments (Groot et al., 2018) in the nursery of the Gesneriad Conservation Center of China (GCCC) in Guangxi Institute of Botany by the authors over the past six years. We also checked specimens (including type specimens) from the following herbaria: A, E, GH, HN, IBK, IBSC, K, MO, PE, UC and VMN (abbreviations follow Thiers 2015). All morphological characters were studied using a dissecting microscope (SZX16, Olympus, Tokyo, Japan). Additionally, photos of the whole plants and flowers were taken with a digital camera (X-H1, Fuji, Sendai, Japan). Characters were described using the terminology presented by Wang et al. (1998).

Specimens examined: *Primulina swinglei*: **CHINA. Guangdong Province:** Huizhou City, Boluo County, Luofu Mountain, 16 August 1917, *C. O. Levine 1538* (IBSC; GH); Boluo County, Luofu Mountain, 28 July 1930, *N. Q. Chen 41431* (IBSC); Boluo County, Luofu Mountain, 13 January 1935, *L. Deng 331* (IBSC); Ruyuan County, Wuyang Town, 18 October 1936, *Y. Li 2014* (IBSC); no specific locality, no exact collection time, *X. R. Liang 69669* (IBK). **Guangxi Zhuang Autonomous Region:** Qinzhou City, 8 July 1912, *K. K. Tsoong 1980* (IBSC); Fangchenggang City, Naliang Town, 7 July 1917, *K. K. Chung s. n.* (IBSC); no specific locality, 15 May 1924, *Kwangsi Mus. 254* (IBSC); Fangchenggang City, Shiwandashan Mt., 14 July 1937, *X. R. Liang 69669* (IBSC); Wuming County, Matou Town, 1 September 1958, *Y.C. Chen 785* (IBK); Nanning, Medicine Hort. Garden, 28 May 1964, *X. C. Huang 00085* (GXMI); Wuming County, Matou Town, 25 June 1965, *X. C. Huang, H. R. Zhu, C. Y. Xie 3814* (GXMI, PE); Nanning City, Medicine Hort. Garden, 21 April 1975, *G. Y. Yang 7007* (GXMG); Lingshan County, Taiping Town, 11 July 1977, *Lingshanzu 1-4041* (GXMI); no specific locality, 25 June 1978, *Chengjunzu 00624* (GXMI); Shanglin County, Dafeng Town, 2 July 1978, *Shanglindui 2-725* (GXMI); Nanning City, Medicine Hort. Garden, 4 July 1979, *Z. Y. Ni, M. L. Chen 8028* (GXMG); Nanning City, Medicine Hort. Garden, 1 September 1981, *X. H. Lu 9032* (GXMG); Nanning City, Medicine Hort. Garden, 22 October 1981, *Z. Y. Ni 9035* (GXMG); Fangchenggang City, Fulong Town, 9 July 2010, *Shiwandashancaijidui 2672* (IBK); Fangchenggang City, Fulong Town, 10 July 2010, *Shiwandashancaijidui 2723* (IBK); Fangchenggang City, Fulong Town, 11 July 2010, *Shiwandashancaijidui 2791* (IBK); Fangchenggang City, Dongzhong Town, 19 July 2010, *Shiwandashancaijidui 3191* (IBK); Wuming County, Daming Mountain, 9 August 2010, *L. Wu, R. H. Jiang, et al. D0839* (IBK); Wuming County, Daming Mountain, 10 August 2010, *L. Wu, R. H. Jiang, et al. D0919* (IBK); Wuming County, Daming Mountain, 7 July 2011, *L. Wu, S. L. Jin D2566* (IBK); Fangchenggang City, Nasuo Town, 1 August 2012, *W. B. Xu, Y. S. Huang 11713* (IBK); Rong County, 24 March 2015, *W. B. Xu 12124* (IBK). **VIETNAM.** Ton Kin, Mont. Bavi, près de Van-Maou, sur les roches moussues, 22 July 1886, *Balansa 4294* (P); Ton Kin, forêts du Mont. Bavi, sur les bords ombragés et rocheux des torrents, July 1887, *Balansa 4287* (Kew, P); Ton Kin, July 1887, *Balansa, Benedict 4287* (E); Ton Kin, 1 September 1939, *W. T. Tsang 29473* (IBSC); Ton Kin, Ha Coi, Tong Fa, Taai Wong Mo Shan, 11-23 September 1939, *3rd Indo-China*

Expedition W. T. Tsang 09475, 29473 (E); Ton Kin, de Sontay, Mont Bavi, April 1940, 7.223 (E); Ton Kin, Dam Ha, Sai Wong Mo Shan, July to September 1940, 4th Indo-China Expedition W. T. Tsang 30186 (E); Cao Bang, Tra Linh, Quoc Toan, 25 May 1997, L. Averyanov, N. T. Hiep VH4903 (E); Huong Son District, Ngam Thiep, 23 May 1998, N. T. Hiep, P. K. Loc, N. Q. Binh, L. Xiem 847 (E); Quan Binh, Ninh Hoa, Hoa Tien, 30 April 2011, L. A. Averyanov, P. K. Loc, N. Q. Hieu, P. V. The, N. T. Vinh CPC 2547 (E).

***Primulina laxiflora*: CHINA. Guangdong Province:** Dapu County, Gucun Town, 13 June 1957, L. Deng 5161 (IBSC). **Guangxi Zhuang Autonomous Region:** Heng County, Zhenlong Distriton, 8 May 1957, Z. Z. Chen 50480 (IBSC); Lingyun County, 17 June 1961, S. W. Chen 19753 (IBK); Longzhou County, Nonggang, Minqiang, 19 July 2009, R. H. Jiang, W. H. Wu, D. X. Nong H09212 (IBK); Longzhou County, Nonggang, Xiangshui, 29 July 2009, Y. S. Huang, X. X. Ye, L. Wu H09835 (IBK); Longzhou County, Nonggang, Liaowangtai, 3 March 2011, Y. S. Huang y0067 (IBK); Longzhou County, Nonggang, Xiangshui, 25 September 2011, Y. Liu, R. C. Peng JRH2485 (IBK); Fengshan County, Jiangzhou Town, 24 July 2014, X. Y. Huang, Y. D. Peng, J. H. Li 451223140724022LY (GXMG); no specific locality, no exact collection time, L. Q. Chen 90123 (IBSC). **VIETNAM.** Xuan Truong, Bao Lac, no exact collection time, V. T. Do, F. Wen, L. F. Fu VNM-CN 801 (VMNM); Dak Rong Natural Reserve, Quang Tri Prov, no exact collection time, V. T. Do, F. Wen, Y. G. Wei, Z. B. Xin VMN-CN 964 (VMNM); Bavi National Park, no exact collection time, V. T. Do, F. Wen, Y. G. Wei, Z. B. Xin VMN-CN 1138 (VMNM); Ha Giang, Bac Me, Bac Me Nature Reserve, 16 June 2012, V. T. Do, F. Wen VMN-CN229 (VMN, IBK).

3 Results and Discussion

E.D. Merrill from the Bureau of Science of Manila spent his annual leave from August 9th to 27th, 1917) exploring the Luofu Mountain in Guangdong Province, China, for botanical field collection with C. O. Levine from the Canton Christian College. On this trip, Merrill made a collection aggregating 544 numbers. Levine also made an extensive collection in the same period and the same locality. In 1918, *Didymocarpus swinglei* Merr. (1918: 156) was first described by Merrill based on the type specimens: E. D. Merrill 10692 and the additional collections, C. O. Levine 1538 (Vitek et al., 2000). It was placed in the genus *Didymocarpus* Wallich (1819: 378) because of the unilobed linguiform shape of the stigma (Merrill 1918). The specie is named after Walter T. Swingle from the United States Department of Agriculture, who made Merrill's trip to China possible. However, in the protologue, Merrill did not indicate which of the two specimens he cited was the holotype.

When revising the family, Wang established the Series *Swinglei* W. T. Wang (1981: 62), but he did not have the opportunity to check the type specimens. Wang referenced the specimens C. O. Levine 1538 ([IBSC, barcode no. 0549123, 0649578], L. O. Levine in Wang's paper is a mistake), which were collected at the same locality by Levine on August 16th, 1917, and indicated it as the paratype (Wang, 1981, 1985). Thus, almost all duplicates of C. O. Levine 1538 stored in different herbaria were indicated as type specimens of *Primulina swinglei* (i.e. IBSC0549123, IBSC0649578, and GH00015873), and were respectively annotated as paratype, syntype and isoparatype on the sheets. In these articles, Wang (1981, 1985) also referenced specimen Chen 41431, mistakenly identified as topotype on the sheet [IBSC, barcode no. 0004889, 0549115]

which was collected at the same locality in July 28th, 1930, and he also referenced Liang 69669 [IBK, barcode no. 00054451] collected in the Shiwandashan Mountain, Guangxi Zhuang Autonomous Region. The latter was identified as *Chirita pellegriniana* Burt (1960: 98) by Wood (1974), which is a synonym of *Primulina swinglei* (Wang et al., 1990, 1998; Weber et al., 2011).

In Vietnam, *Didymocarpus balansae* Pellegrin (1926: 415) was described based on B. Balansa's collections from Mont Bavi (Tonkin) in 1886-1887 and was recognized as an endemic species (Pellegrin & Lecomte, 1930). Both specimens (Balansa 4287 and Balansa 4294) were simultaneously designated as types (Pellegrin, 1926). It was regarded as a synonym of *Chirita pellegriniana* by Burt (Burt, 1960). Later, it was considered to be conspecific with *Primulina swinglei* (Wang, 1985; Wang et al., 1998; Weber et al., 2011), so that, these types were designated as the syntypes of *P. swinglei*.

Primulina laxiflora was described on the basis of a single collection, S. W. Chen 19753 [PE00030667 (Fig. 1)], and recognized as an endemic from Lingyun County, NW Guangxi, China (Wang et al., 1998; Li & Wang, 2005; Wei et al., 2010). Since its publication, this taxon has been generally considered to be very similar to *P. swinglei*, but to differ by a smaller leaf blade, 6–9.6 cm long (vs. 6–6 cm long), smaller corolla, ca. 1.7 cm long (vs. 2.4–4.2 cm long), tube nearly tubular (vs. campanulate to funnelform) and abaxial corolla lip 0.6–1.5 cm long (vs. 1–3 cm long) (Wang, 1985; Wang et al., 1998). While *P. swinglei* has a wide geographic distribution, predominantly from eastern Guangdong through Guangxi to northern Vietnam, where it grows in a variety of different habitats (Karst and granite landscapes), with most populations occurring in Karst landscapes (Do et al., 2013). We notably observed different individuals from the type locality of *P. swinglei*, Luofu Mountain of Guangdong, China, and found that many small individuals can get to bloom. After consulting the original and relevant literature (Merrill, 1918; Pellegrin, 1926; Burt, 1960; Weber et al., 2011), conducting field observations (Fig. 2) and examinations of the type materials and other collections, we considered that *P. laxiflora* is conspecific with *P. swinglei*. Consequently, we are proposing to reduce *P. laxiflora* as a synonym of *P. swinglei*.



图 1 疏花报春苣苔模式标本 (存放于中国科学院植物研究所标本馆, PE00030667)
Fig. 1 Holotype of *Primulina laxiflora* (W. T. Wang) Yin Z. Wang (= *P. swinglei*) [Herbarium of Institute of Botany (PE), Beijing, China, No. PE 00030667]



A. 钟冠报春苣苔; B. 疏花报春苣苔。1. 野外居群; 2. 开花植株; 3. 花冠正面; 4. 花冠筒侧面。
A. *Primulina swinglei*; B. *P. laxiflora*. 1. Habitat; 2. Plant(s) in flowering; 3. Frontal view of corolla; 4. Lateral view of corolla.

图2 钟冠报春苣苔与疏花报春苣苔形态对比

Fig. 2 Comparison of *Primulina swinglei* and *P. laxiflora*

4 Taxonomic Treatment

Primulina swinglei (Merr.) Mich. Möller & A. Weber in Taxon 60: 785. 2011; —*Didymocarpus swinglei* Merrill, in Philipp. J. Sci. 13: 156. 1918—*Chirita swinglei* (Merr.) W. T. Wang, in Bull. Bot. Res., Harbin 1(4): 62. 1981;—*Chirita pellegriniana* B. L. Burtt, in Notes Roy. Bot. Gard. Edinburgh 23: 98. 1960; —*Didymocarpus balansae* Pellegrin, in Bull. Soc. Bot. France 73: 415. 1926.

– **Lectotype (designated here):** CHINA. Guangdong Province: Huizhou City, Boluo County, Luofu Mountain, 9th to 27th August 1917, E. D. Merrill 10692 (lectotype, NY Herb. No. 63230 [Fig. 3]; isoelectotypes: IBSC Herb. No. 0649577; UC Herb. No. 301080).

= *Primulina laxiflora* (W. T. Wang) Yin Z. Wang **syn. nov.** Type:—CHINA. Guangxi Province: Lingyun County, rocks in limestone hills, 17 June 1961, S. W. Chen 19753 (holotype, PE Herb. No. 00030667).

For a full description of *Primulina swinglei* see Wang et al. (1998) and Li & Wang (2005).

Distribution and habitat:—South China (Guangdong Province, Guangxi Zhuang Autonomous Region), North Vietnam (Hà Giang Province, Cao Bằng Province, Ninh Bình Province, Ba V ìmountain range)

Conservation status:—During our fieldwork, we found that farmlands and rubber plantations were expanding in these areas, which would result in deforestation, habitat loss, and fragmentation of this species. However, due to the fact that the populations found in Guangxi and Guangdong of China and from Vietnam are composed of numerous individuals, and populations regenerate well; we estimate that this species will not suddenly become extinct. Furthermore, the individuals and populations of *Primulina swinglei* are abundant in the two countries. Thus, following the IUCN (2017) red list categories and criteria, the conservation status of this species is of Least Concern (LC).

chinaXiv:202010.00042v1

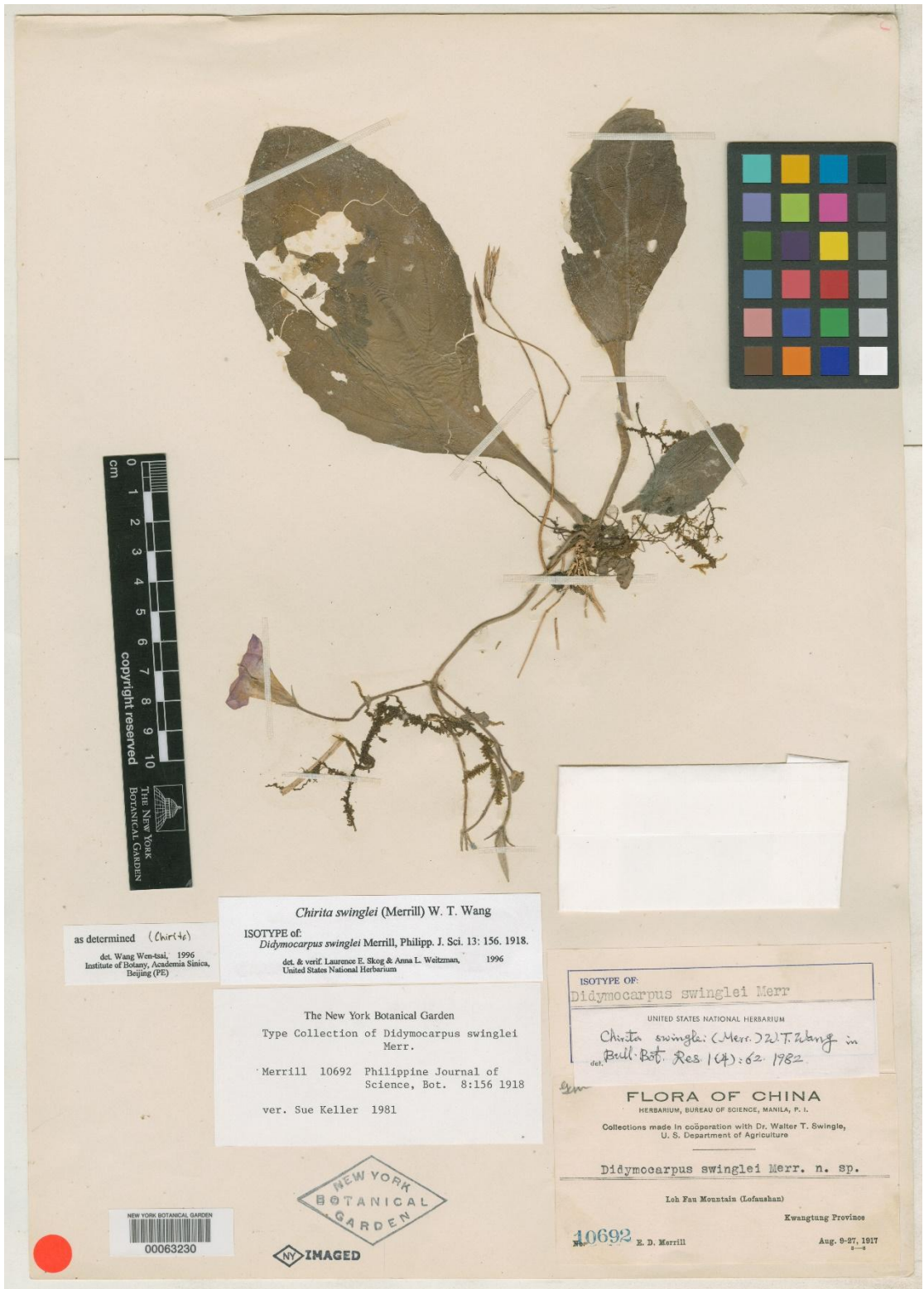


图 3 钟冠报春苣苔的选定模式标本（纽约植物园标本馆，NY63230）

Fig. 3 Lectotype of *Primulina swinglei* (Merr.) Mich. Möller & A. Weber (Herbarium of New York Botanical Garden, New York, USA, No. NY63230)

References:

- BURTT BL, 1960. Studies in the Gesneriaceae of the Old World XX[J]. Misc Notes Roy Bot Gard Edinburgh, 23: 94–102.
- DON D, 1822. Descriptions of two new genera of Nepaul plants[J]. Edinburgh Phil J, 7: 82–86.
- DO VT, LIU SY, WEI YG, et al., 2013. Four newly recorded Gesneraceous species from Vietnam[J]. Guihaia, 33(3): 115–120. [Do Van Truong, 刘晟源, 韦毅刚, 等, 2013. 越南苦苣苔科植物四新记录种(英文)[J]. 广西植物, 33(3): 115–120.]
- LI ZY, WANG YZ, 2005. *Primulina*, *Chirita* and *Chiritopsis*[M]//LI ZY, WANG YZ (eds.). Plants of Gesneriaceae in China. Zhengzhou: Henan Science and Technology Publishing House: 170–282. [李振宇, 王印政, 2005. 报春苣苔属, 唇柱苣苔属和小花苣苔属[M]//李振宇, 王印政. 中国苦苣苔科植物. 郑州: 河南科学技术出版社: 170–282.]
- GROOT MP, WAGEMAKER N, OUBORG NJ, et al., 2018. Epigenetic population differentiation in the field- and common garden-grown *Scabiosa columbaria* plants[J]. Ecol Evol, 8(6): 3505–3517.
- MERRILL ED, 1918. Notes on the flora of Loh Fau Mountain, Kwangtung Province, China[J]. Philippine J Sci, Section C, Botany, 13: 123–161.
- MÖLLER M, 2019. Species discovery in time: An example from Gesneriaceae in China[J]. Guangxi Sci, 26(1): 1–16. [Möller M, 2019. 物种的及时发现: 以中国苦苣苔科植物为例[J]. 广西科学, 26(1): 1–16].
- MÖLLER M, WEI YG, WEN F, et al., 2016. You win some you lose some: Updated generic delineations and classification of Gesneriaceae-implications for the family in China[J]. Guihaia, 36(1): 44–60. [Möller M, 韦毅刚, 温放, 等, 2016. 得与失: 苦苣苔科新的属级界定与分类系统——中国该科植物之变迁[J]. 广西植物, 36(1): 44–60.]
- PELLEGRIN F, 1926. Les Gesnéracées-Cyrtandrées d'Indo-Chine[J]. Bull de la Société Bot de France, 73(3): 412–429.
- PELLEGRIN F, LECOMTE H, 1930. Gesneriaceae[M]. Flore générale de L'Indo-Chine, 4: 487–565.
- THIERS B, 2015. [continuously updated] Index herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden[DB/OL]. <http://sweetgum.nybg.org/ih/> [accessed 3 Feb 2015].
- TURLAND NJ, WIERSEMA JH, 2017. Synopsis of Proposals on Nomenclature – Shenzhen 2017: A review of the proposals concerning the International Code of Nomenclature for algae, fungi, and plants submitted to the XIX International Botanical Congress[J]. Taxon, 66 (1): 217–274.
- TURLAND NJ, WIERSEMA JH, BARRIE FR, et al., 2018. International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017[M]. Glashütten: Koeltz Botanical Books. Regnum Vegetabile: 159. DOI: <https://doi.org/10.12705/Code.2018>.
- VITEK E, WEBER A, BURTT BL, 2000. Names, types and current placement of the species hitherto referred to *Didymocarpus*, *Loxocarpus*, *Codonoboea*, *Platyadenia* and *Henckelia* (Gesneriaceae)[J]. Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie, 102: 477–530.
- WALLICH N, 1819. Notice of the progress of botanical science in Bengal [letter to F. Hamilton][J]. Edinb Phil J, 1: 376–381.

- WANG WT, 1981. Notulae de Gesneriaceis Sinensibus (II) [J]. Bull Bot Res, 1(4): 35–75. [王文采, 1981. 中国苦苣苔科的研究 (二) [J]. 植物研究, 1(4): 35–75.]
- WANG WT, 1984a. Notulae De Gesneriaceis Sinensibus (V)[J]. Bull Bot Res, 4(1): 9–35. [王文采, 1984. 中国苦苣苔科的研究 (五) [J]. 植物研究, 4(1): 9–35.]
- WANG WT, 1984b. A revision of the genus *Chirita* (Gesneriaceae) in China (I) [J]. Bull Bot Res, 5(2): 71–97. [王文采, 1984. 中国唇柱苣苔属校订(I)[J]. 植物研究, 5(2): 71-97.]
- WANG WT, 1985. A revision of the genus *Chirita* (Gesneriaceae) in China (II) [J]. Bull Bot Res, 5(3): 37–86. [王文采, 1985. 中国唇柱苣苔属校订(II)[J]. 植物研究, 5(3): 37-86.]
- WANG WT, 1990. Gesneriaceae [M]//WANG WT. Flora Republicae Popularis Sinicae. Beijing: Science Press, 69: 125-581. [王文采, 1990. 苦苣苔科[M]//王文采. 中国植物志. 北京: 科学出版社, 69: 125-581.]
- WANG WT, PAN KY, LI ZY, 1998. Gesneriaceae [M]//WU CY, RAVEN PH (eds). Flora of China. Beijing: Science Press; St. Louis: Missouri Botanical Garden Press, 18: 322.
- WANG YZ, MAO RB, LIU Y, et al., 2011. Phylogenetic reconstruction of *Chirita* and allies (Gesneriaceae) with taxonomic treatments[J]. J Sys Evol, 49(1): 50–64.
- WEI YG, WEN F, MÖLLER M, et al., 2010. Gesneriaceae of South China[M]. Nanning: Guangxi Science and Technology Publishing House. [韦毅刚, 温放, Möller M, 等, 2010. 华南苦苣苔科植物[M]. 南宁: 广西科学技术出版社.]
- WEBER A, MIDDLETON DJ, FORREST AL, et al., 2011. Molecular systematics and remodelling of *Chirita* and associated genera (Gesneriaceae)[J]. Taxon, 60 (3): 767–790.
- WEN F, LI S, XIN ZB, et al., 2019. The updated plant list of Gesneriaceae in China under the new Chinese naming rules[J]. Guangxi Sci, 26(1): 37–63. [温放, 黎舒, 辛子兵, 等, 2019. 新中文命名规则下的最新中国苦苣苔科植物名录[J]. 广西科学, 26(1): 37-63.]
- WOOD D, 1974. A revision of *Chirita* (Gesneriaceae)[J]. Notes Roy Bot Garden Edinb, 33: 123–205.